Lat 39.33157 Lon -120.22461

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Reply to: 3420

Date: September 18, 1996

Subject: Bark beetle-related mortality in the Northwoods Project area (Report NE96-12)

To: District Ranger, Truckee Ranger District, Tahoe National Forest

At the request of Karen Jones, District Silviculturalist, I conducted a field evaluation of the Northwoods project area on September 11, 1996. The objective of the field visit was to determine what bark beetles were involved with the conifer mortality and to discuss what options are available to limit/reduce mortality levels in the immediate future and long term. The area examined includes two 80 acre parcels of National Forest land surrounded by private land (see attached map). These parcels are in the urban interface with the Tahoe Donner subdivision and are visible from Interstate 80, therefore, they have high visibility and warrant immediate concern regarding the current bark beetle outbreak and the fuels buildup.

Current Condition

Jeffrey and lodgepole pine mortality in all size classes is occurring in these two parcels. The mortality is due primarily to the protracted, below normal precipitation period between 1987 and 1994, overstocking and successful attacks by Jeffrey pine beetles, Dendroctonus jeffreyi and mountain pine beetles, Dendroctonus ponderosae (detailed information attached). Species composition is dominated by Jeffrey pine with lessor components of sugar pine, white fir and incense cedar. There are several wet areas in these parcels which are dominated by lodgepole pine. Most of this area was cut heavily around the turn of the century and has regenerated naturally. There are some large diameter remanent Jeffrey pines scattered throughout the parcels however, most trees are about 100 years old. No management activities have taken place in these parcels since the turn of the century resulting in current basal areas that range from about 300 - 400 sq. feet/acre.

This area is east of Northwoods Blvd. and below the Tahoe Donner subdivision. Extensive fuel break work has been completed in the private ownership areas around the subdivision. The private parcels immediately surrounding the National Forest land have been thinned within the last three years and have additional salvage and thinning currently going on.

Jeffrey pine

Jeffrey pine ranging from about 5" to >40" DBH are affected. Based on tree condition the Jeffrey pine beetle infestation appears to have started about three years ago. The number of trees attacked in subsequent years has increased annually. Prior to 1996 the mortality encompassed about 20 acres

per parcel. In the immediate vicinity of last years group kills there are several large pockets (10-15 acres per parcel) of trees that were attacked during the flight season this year. These trees are considered to be "green infested" which implies that they have been successfully attacked by Jeffrey pine beetle. The combination gallery construction, larval feeding and the inoculation of the tree with blue stain fungi will cause tree death. Tree crowns may begin to fade late this fall but complete fading may not become apparent until the spring of next year. Jeffrey pine beetles do not tend to fly far after emerging, so group kills tend to increase in size over several years if the beetle populations remain high and the trees remain susceptible to successful attack.

In general, Jeffrey pine beetle-related mortality on the east side has not declined as anticipated following the past two normal or above normal precipitation years. Based on the number of Jeffrey pine trees attacked this year (in the vicinity of last years group kills) the level of mortality is remaining the same if not increasing in many areas.

Lodgepole pine

The wet areas that we examined have extensive lodgepole pine mortality associated with attacks by the mountain pine beetle. Mortality has been occurring in these wet areas for several years with additional bark beetle attacks still ongoing. Typical mortality has occurred throughout the area in large group kills (50 - 100+ trees/group) of the co-dominant and dominant lodgepole pine. In many of the wet areas there are very few live trees remaining. Standing and down fuel loading is high and there is little if any conifer regeneration occurring.

These lodgepole pine stands have the characteristics of being highly susceptible to mountain pine beetle attack: dominated by trees greater the 8" DBH, greater than 80 years old, a pure or nearly pure lodgepole type, overstocked and a history of infestation in surrounding areas. In addition to these characteristics, the recent protracted drought period with annual precipitation below normal six of the past nine seasons, has placed additional stress on the trees making them favorable hosts for successful bark beetle attack. In these areas, the rise (anaerobic conditions for the roots) and fall (drought) of the water table may also play a role in tree susceptibility to bark beetle attacks.

DISCUSSION

The priority issue identified was the Jeffrey pine mortality which is wide spread throughout the two parcels and is currently at an unacceptable level. Of immediate concern was whether direct suppression of the Jeffrey pine beetles was a realistic option to reduce the mortality levels within the National Forest parcels. Circumstantially successful Jeffrey pine beetle suppression projects are ongoing in the Lake Tahoe Basin Management Unit and in Lassen Volcanic National Park. The objective of these projects is to identify and remove all green infested trees prior to beetle flight on an annual basis until an acceptable level of mortality is obtained and maintained. Projects have been highly successful at reducing the number of infested trees in the year following the suppression project.

For a suppression project to be efficacious in terms of reducing mortality the infested trees need to be removed or have the bark peeled prior to beetle emergence in June of 1997. Based on the observations in the parcels, newly infested trees are in the immediate vicinity of trees that faded this year indicating that suppression efforts would be a viable option to consider in an attempt to reduce further mortality associated with the group kills. With the current number of green infested trees, bark peeling is not a feasible option. Removing trees by helicopter or ground based equipment over the snow are options. In addition, the current management activities being conducted in the adjacent private lands are removing green infested trees as well as thinning to increase growth and improve vigor. These activities combined with treatments on the National Forest parcels will reduce the level of mortality in subsequent years enabling all ownerships to meet their management goals and objectives and improve forest health conditions such that the vegetation is more resilient to the frequent protracted drought periods experienced in California.

Based on the current level of infestation, the likelihood of the beetles emerging next year and attacking additional Jeffrey pine trees remains high. In anticipation of conducting a suppression project, efforts are ongoing to map the green infested trees within the parcels to better document the level of infestation and determine the scope of the project.

The level of annual mortality in the lodgepole pine did not declined this year. The current generation of mountain pine beetles will emerge into the stands that remain highly susceptible causing additional mortality in subsequent years. Some moisture stress relief may be seen with the recent above normal precipitation, however, mortality is likely to continue at a higher level in these stands until the stand conditions are altered either naturally by mountain pine beetle or through planned management activities.

Based on data from the ongoing mountain pine beetle suppression project at Donner Camp, removal of green infested lodgepole trees prior to beetle emergence will reduce the number of infested trees in the immediate vicinity. However, completion of an analysis of the wet areas in terms of effects from management activities or lack thereof is not possible in time for a suppression project in the spring of 1997.

Management Alternatives

1. **Do nothing.** Jeffrey pine beetle and mountain pine beetle will continue to remain active until stand conditions are altered. Eventually residual live trees will respond to the thinning out of the stands by bark beetles coupled with the increase in moisture over the past two years. The current condition of these stands has been the result, in part, of no management. The continuing result of this alternative will be unacceptable levels of mortality, large unplanned openings and increasing amounts of standing dead trees and down woody material. With the current outbreak of mountain pine beetle and Jeffrey pine beetle it is likely the stands will become dominated primarily by white fir in the near future.

2. **Direct Control.** To implement this alternative a complete survey of all Jeffrey and lodgepole pine trees with live crowns would be necessary to

determine which trees have been successfully attacked (green infested). Green infested trees would need to be removed from the site, by June 1, 1997, prior to beetle emergence. Yearly treatment and surveillance would be required dependent upon beetle activity. The stands will remain susceptible to bark beetles until stand conditions are altered by long-term management. Based on information from other areas where this alternative has been implemented for these beetles, the number of infested trees in the immediate vicinity will be greatly reduced next year. Reducing the level of mortality will provide more options for management in the future. Planned management activities, contrasted with no management, will result in stands meeting goals and objectives in terms of species composition, tree spacing and stocking levels, crown closure, wet area condition, fuel loading, snag recruitment and other desired components.

3. **Salvage.** Implementation of this alternative would result in the removal of all dead and dying trees in the two parcels without restrictions on dates of tree removal for green infested trees. Value from the wood sales would be realized and the fuel loading would be reduced, however, the underlying causes of stand/tree susceptibility would not be altered to prevent/reduce future mortality. Based on the current trend over the past 2 years, Jeffrey pine beetles and mountain pine beetles will emerge next year and continue to cause unacceptable levels of mortality. A salvage treatment occurring next summer would remove green infested trees, however, it would not take place until another beetle flight has occurred therefore additional mortality should be expected if this alternative alone is selected. Because of the "group kill" characteristic in these stands there will be openings larger than desired after salvage removal. Some type of revegetation in these areas may be desirable.

4. **Prevention.** The objective of management opportunities incorporating prevention would be to reduce the susceptibility of the trees to bark beetle attacks. Preventative treatments can include thinning to promote stand growth and vigor and/or insecticide treatment to limit successful attacks.

A. Thinning. Thinning could be used to reduce the stocking in the clumps of trees. Based on the initial field visit, the level of currently infested trees in these parcels is quite high so additional subsequent thinning opportunities may already be minimized. Currently a stand exam is being completed for the areas. Based on stand exam data, silviculture prescriptions can be developed to meet the overall objectives. A thinning treatment occurring next summer would remove green infested and uninfested trees, however, it would not take place until another beetle flight has occurred. Therefore, additional mortality should be expected if this alternative alone is selected. Treatment of fresh conifer stumps with a registered borate compound to reduce the probability of annosus root disease infection should be considered.

B. Insecticide treatment. All noninfested Jeffrey and lodgepole pines greater than 8"DBH would be treated with a registered insecticide by spraying as much of the bole as possible. Although efficacious, this alternative is not feasible as the parcels have limited access, several wet areas and the cost would likely be prohibitive.

Conclusions

To reduce/limit unacceptable levels of bark beetle-related mortality in the two parcels consideration should be given to implementation of one or more of the above alternatives. A combination of direct control, thinning, and salvage would likely enable the District to meet it management objectives in the future. Forest Pest Management can assist in the further development and implementation of any of the described alternatives. In addition, Forest Pest Management prevention/suppression funds can be used for treatments. Potential suppression/prevention funding opportunities include funds that are available as FY96 carryover and/or from the submission and funding of an FY97 project proposal.

I am working with Karen Jones on the procedures for requesting Forest Pest Management Suppression funds for a project involving direct control to be implemented in late winter/early spring next year. Subsequent long-term management alternatives, to include salvage, thinning, and underburning, will lead to the desired future condition for this area. Please contact Sheri Smith (916-257-2151) if you have questions regarding this evaluation or need further assistance.

Sheri Lee Smith
Entomologist
NE CA Shared Service Area

cc: Rick Maddalena, Truckee RD, Tahoe NF
cc: Karen Jones, Truckee RD, Tahoe NF

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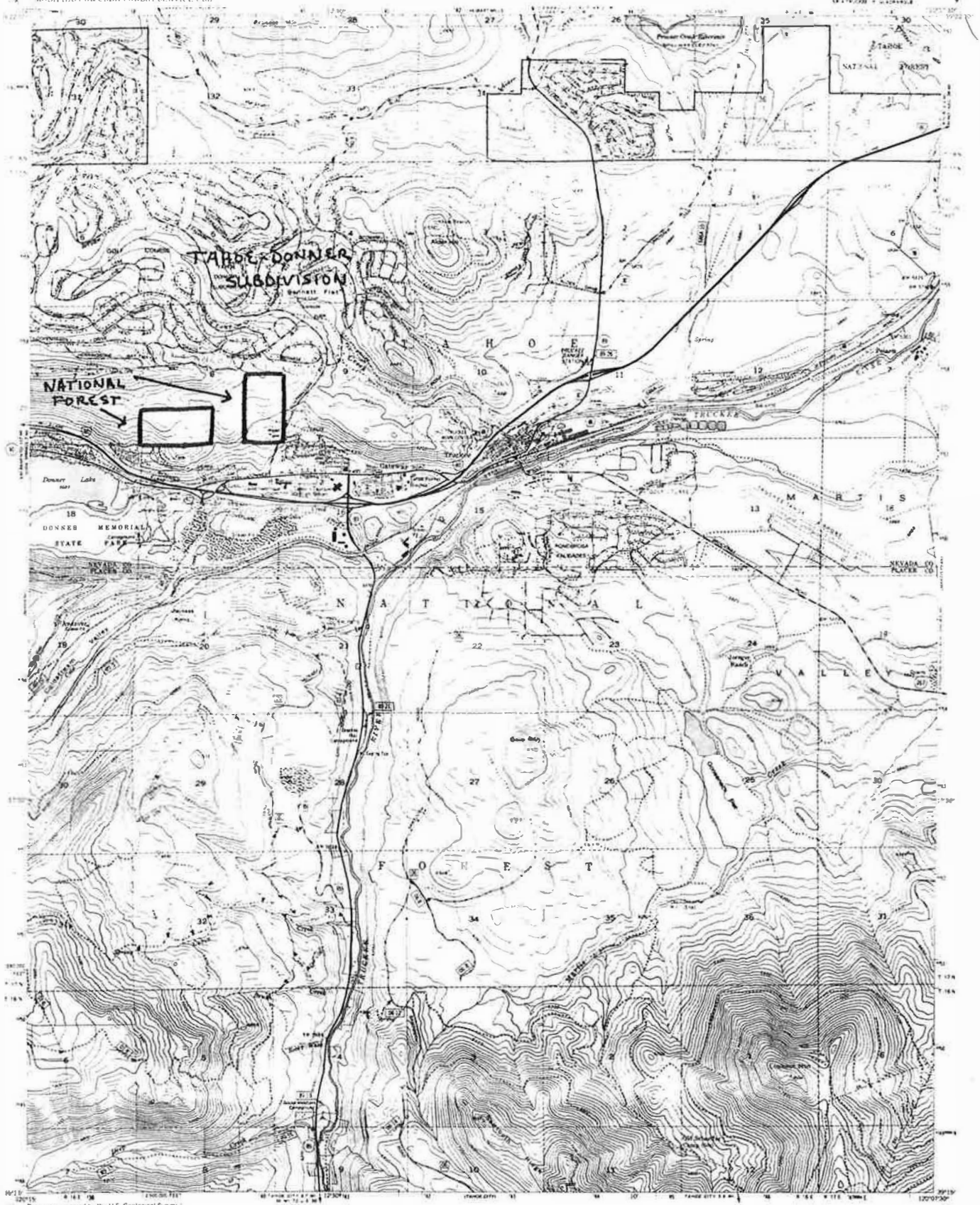
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Jeffrey Pine Beetle, Dendroctonus jeffreyi

The Jeffrey pine beetle is the principle bark beetle found attacking Jeffrey pine, which is its only host. It is a native insect occurring from southwestern Oregon southward through California and western Nevada to northern Mexico. The beetle normally breeds in slow-growing, stressed trees. The beetles prefer trees which are large, mature, and occur singly rather than in groups. When an epidemic occurs, the beetle may attack and kill trees greater than 8 inches in diameter, regardless of age or vigor. Often the beetle infests lightning-struck or wind-thrown trees, but does not breed in slash.

Evidence of Attack

Presence of the beetle is usually detected when the foliage changes color. The color change of the foliage is related to the destruction of the cambium layer by the beetle. Generally, the top of the crown begins to fade in a slow sequence, with the needles turning from greenish yellow, to sorrel, and finally to reddish brown. By the time the tree is reddish brown, the beetles have usually abandoned the tree. Another sign of beetle attack is large, reddish pitch tubes projecting from the bark of the infested tree. If examined carefully, pitch tubes can be detected on infested green trees prior to crown fade. Jeffrey pine beetles have a distinctive "J" shape egg gallery pattern on the inner bark. Larval mines extend across the grain and end in open, oval-shaped pupal cells.

Life Stages and Development

The Jeffrey pine beetle is one of the larger pine bark beetles in California. The beetle has four life stages, egg, larva, pupa, and adult. The adults are stout, cylindrical, black, and approximately five-sixteenths of an inch long when mature. The egg is oval and pearly-white. The larva is white, legless, and has a yellow head. The pupa is also white but is slightly smaller than the mature larva. The life cycle is normally completed in one year in the northern part of the range, but in the southern part, two generations per year may occur. The principle period of attack is in June and July, but attacks also are frequent in late September and early October. Similar to other Dendroctonus species, Jeffrey pine beetles use pheromones that attract other beetles to a tree, causing a mass attack that tends to overcome the tree's natural resistance. Bluestain fungi are associated with Jeffrey pine beetle attacks and aid in overcoming the tree.

Conditions Affecting Outbreaks

Normally the Jeffrey pine beetle is kept in check by its natural enemies, climatic factors, and the resistance of its host. Similar to other Dendroctonus species, the availability of suitable host material is a key factor influencing outbreaks. Healthy trees ordinarily produce abundant amounts of resin, which pitches out attacking beetles. When deprived of moisture, trees cannot produce sufficient resin flow and they become susceptible to successful beetle attacks.

Mountain Pine Beetle, Dendroctonus ponderosae

The mountain pine beetle attacks the bole of ponderosa, lodgepole, sugar and western white pines larger than about 8 inches dbh. Extensive infestations have occurred in mature lodgepole pine forests. Group killing often occurs in mature forests and young overstocked stands of ponderosa, sugar and western white pines.

Evidence of Attack

The first sign of beetle-caused mortality is generally discolored foliage. The mountain pine beetle begins attacking most pine species on the lower 15 feet of the bole. Examination of infested trees usually reveals the presence of pitch tubes. Pitch tubes on successfully infested trees are pink to dark red masses of resin mixed with boring dust. Creamy, white pitch tubes indicate that the tree was able to "pitch out" the beetle and the attack was not successful. Besides having pitch tubes, successfully infested trees may have dry boring dust in the bark crevices and around the base of the tree. Infested trees can also have boring dust, but not pitch tubes. This may be common in drought years when trees produce little pitch. Attacking beetles carry with them the spores of blue-staining fungi. As the fungi develop and spread throughout the sapwood, they interrupt the flow of water to the crown. The fungi also reduces the flow of pitch in the tree, thus aiding the beetles in overcoming the tree. The combined action of both beetles and fungi causes the tree to die and the needles to discolor.

Life Stages and Development

The beetle develops through four stages: egg, larva, pupa and adult. The life cycle of the mountain pine beetle varies considerably over its range. One generation per year is the general rule, with attacks occurring from late June through August. Two generations per year may develop in low elevation sugar pine. Females making their first attacks release aggregating pheromones. These pheromones attract males and other females until a mass attack overcomes the tree. The adults bore long vertical egg galleries and lay eggs in niches along the sides of the gallery. The hatching larvae feed in mines perpendicular to the main gallery and construct small pupal cells at the end of these mines where they pupate and transform into adults.

Conditions Affecting Outbreaks

The food supply regulates populations of the beetle. In lodgepole pine, it appears that the beetles select larger trees with think phloem, however the relationship between beetle populations and phloem thickness in other hosts has not been established. A copious pitch flow from the pines can prevent successful attack. The number of beetles, the characteristics of the tree, and the weather affect the tree's ability to produce enough resin to resist attack. Other factors affecting the abundance of the mountain pine beetle include low winter temperatures, nematodes, woodpeckers and predaceous and parasitic insects. As stand susceptibility to the beetle increases because of age, overstocking, diseases or drought, the effectiveness of natural control decreases and mortality increases.